IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE

BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Wang, et al.

Application Serial No.: 10/700,625 Group Art Unit: 2886

Filed : 11/05/2003 Examiner: AKANBI, I.

Confirmation No: 6272

Title : OPTICAL PROFILER FOR ULTRA-SMOOTH SURFACE WITH NORMAL INCIDENT BEAM DEFLECTION METHOD

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal.

Appellant appeals from the final rejection of claims 1, 5-11, 15-18, 21, and 22.

REAL PARTY IN INTEREST

The real party in interest is SEAGATE TECHNOLOGY LLC, which is the assignee of record.

RELATED APPEALS AND INTERFERENCES

There are no related appeals, interferences, or judicial proceedings known to the Appellant which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

1. Claims canceled: 2-4, 12-14, and 19-20

2. Claims withdrawn from consideration, but not canceled: None

3. Claims pending: 1, 5-11, 15-18, 21, and 22

4. Claims allowed: none

5. Claims objected to: none

6. Claims rejected: 1, 5-11, 15-18, 21, and 22

7. Claims on appeal: 1, 5-11, 15-18, 21, and 22

STATUS OF AMENDMENTS

No Amendment was filed subsequent to the issuance of the Final Office Action mailed 03/24/2009.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent Claim 1 recites an apparatus for measuring surface topography of a surface. The apparatus includes a linearly polarized light source 12 (e.g., Figure 1) that generates a light beam 13 (e.g., Figure 1), as depicted in Figure 1 and paragraph [0018]. Also, the apparatus includes optics 10 (e.g., Figure 1) that focus the light beam on a surface 28 (e.g., Figure 1) to be measured such that a normally incident beam deflection is provided, as depicted in Figure 1 and paragraphs [0018-0021]. The optics includes polarization optics such that the incident beam has a first polarization 15 (e.g., Figure 1) and a reflected beam from the surface has a second polarization 26 (e.g., Figure 1) different from the first polarization, as depicted in Figure 1 and paragraphs [0018-0020]. Moreover, the optics further includes a half-wave plate 14 (e.g., Figure 1) that receives the light beam from the linearly polarized light source; a long working distance microscope objective 16 (e.g., Figure 1) positioned to receive the light beam as an input from the half-wave plate and output a converging light beam 18 (e.g., Figure 1); and a polarizing beam splitter 20 (e.g., Figure 1) positioned to receive as an input the output of the long working distance microscope objective and produce as an output a light beam with the first polarization, as depicted in Figure 1 and paragraphs [0018-0020]. Furthermore, the apparatus includes a position sensitive detector 30 (e.g., Figure 1) positioned to detect the reflected beam, as depicted in Figure 1 and paragraph [0022].

Independent Claim 11 recites a method of measuring the topography of a surface. The method includes directing a beam of light 13 (e.g., Figure 1) of a first polarization towards a surface 28 (e.g., Figure 1) to be measured, as depicted in Figure 1 and paragraphs [0018-0021]. The beam of light is directed at the surface in a direction normally incident to the surface, with a reflected beam 26 (e.g., Figure 1) from the surface also being normally incident to the surface, as depicted in Figure 1 and paragraphs [0018-0021]. The directing includes generating a collimated beam 13 (e.g., Figure 1) of linearly polarized light and passing the collimated beam through a half-wave plate 14 (e.g., Figure 1), as depicted in Figure 1 and paragraph [0018]. Moreover, the directing further includes converging the collimated beam with a long working distance microscope objective 16 (e.g., Figure 1) to output a converging beam 18 (e.g., Figure 1); and transmitting the converging beam through a polarizing beam splitter 20 (e.g., Figure 1) in a direction normally incident to the surface, as depicted in Figure 1 and paragraphs [0019-0021]. Further, the method includes changing the polarization of the reflected beam 26 (e.g., Figure 1) to a second polarization different from the first polarization, as depicted in Figure 1 and paragraph [0020]. Additionally, the method includes directing the reflected beam with the second polarization to a position sensitive detector 30 (e.g., Figure 1), as depicted in Figure 1 and paragraph [0022]. Furthermore, the method includes determining the topography from measurements taken at the position sensitive detector 30 (e.g., Figure 1), as depicted in Figures 1 and 2 and paragraphs [0022-0024].

Independent Claim 21 recites an apparatus for measuring surface topography of a surface. The apparatus includes a linearly polarized light source 12 (e.g., Figure 1) that generates a light beam 13 (e.g., Figure 1), as depicted in Figure 1 and paragraph [0018]. Also, the apparatus includes optics 10 (e.g., Figure 1) that focus the light beam on a surface 28 (e.g., Figure 1) to be measured such that a normally incident beam deflection is provided, as depicted in Figure 1 and paragraphs [0018-0021]. The optics includes polarization optics such that the incident beam has a first polarization 15 (e.g., Figure 1) and a reflected beam from the surface has a second polarization 26 (e.g., Figure 1) different from the first polarization, as depicted in Figure 1 and paragraphs [0018-0020]. The optics further includes a half-wave plate 14 (e.g., Figure 1) that receives the light beam from the linearly polarized light source; a long working distance microscope objective 16 (e.g., Figure 1) positioned to receive the light beam as an input from the half-wave plate and output a converging light beam 18 (e.g., Figure 1); and a polarizing beam splitter 20 (e.g., Figure 1) positioned to receive as an input the output of the long working distance microscope objective and produce as an output a light beam with the first polarization, as depicted in Figure 1 and paragraphs [0018-0020]. Furthermore, the apparatus includes a position sensitive detector 30 (e.g., Figure 1) positioned to detect the reflected beam, as depicted in Figure 1 and paragraph [0022]. Moreover, the optics further includes the polarizing beam splitter having a 45^{o} reflective surface 22 (e.g., Figure 1) positioned to reflect the converging light beam from the long working microscope objective towards the surface in a normally incident direction to the surface, as depicted in Figure 1 and paragraphs [0020-0021].

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1) Claims 1, 5-11, 15-18, 21, and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Fielden et al. (U.S. Patent No. 6,917,419), in view of Toida (U.S. Patent No. 5,428,447).

ARGUMENT

Rejections under 35 U.S.C. 103(a) over Fielden in view of Toida

Claims 1, 5-11, 15-18, 21, and 22

Claims 1, 5-11, 15-18, 21, and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Fielden et al. (U.S. Patent No. 6,917,419), in view of Toida (U.S. Patent No. 5,428,447). Appellant respectfully submits that Claims 1, 5-11, 15-18, 21, and 22 are patentable over Fielden in view of Toida for the reasons discussed below.

Independent Claim 1 recites:

> An apparatus for measuring surface topography of a surface comprising:
> a linearly polarized light source that generates a light beam;
> optics that focus the light beam on a surface to be measured such that a normally incident beam deflection is provided, the optics including polarization optics such that the incident beam has a first polarization and a reflected beam from the surface has a second polarization different from the first polarization, the optics including: a half-wave plate that receives the light beam from the linearly polarized light source; a long working distance microscope objective positioned to receive the light beam as an input from the half-wave plate and output a converging light beam; and a polarizing beam splitter positioned to receive as an input the output of the long working distance microscope objective and produce as an output a light beam with the first polarization; and
> a position sensitive detector positioned to detect the reflected beam.

It is respectfully asserted that a prima facie case of obviousness has not been established because a) the combination of Fielden and Toida fails to

disclose all the features of Independent Claim 1 and because b) the reasoning provided for modifying Fielden is legally insufficient. Thus, Independent Claim 1 is patentable over the combination of Fielden and Toida.

Independent Claim 1 is directed to apparatus for measuring surface topography of a surface and recites in part, "optics including <u>polarization optics such that the incident beam has a first polarization and a reflected beam from the surface has a second polarization different from the first polarization</u>." (Emphasis added) .Further, Independent Claim 1 recites in part, "the optics including: <u>a half-wave plate that receives</u> the light beam from the linearly polarized light source; <u>a long working distance microscope objective positioned to receive</u> the light beam as an input from the half-wave plate and output a converging light beam; and <u>a polarizing beam splitter positioned to receive</u> as an input the output of the long working distance microscope objective and produce as an output a light beam with the first polarization." (Emphasis added).

On pages 2-4 of the Final Office Action mailed 03/24/2009, Examiner argues element 48 of Fielden's Figures 3 and 4 corresponds to "a wave plate" and "a long working distance microscope objective" of Independent Claim 1. Further, Examiner contends element 48 of Fielden's Figure 3 corresponds to "optics including polarization optics such that the incident beam has a first polarization and a reflected beam from the surface has a second polarization different from the first polarization" of Independent Claim 1. Moreover, at page 3 Examiner states, "<u>Fielden teaches of optical component (figs. 3 and 4: 48) that is</u>

capable of being arranged in the same manner as recited in the instant application claims 1, 11, and 21, that may includes beam splitters or dichroic mirrors, quarter wave plates, polarizers such as linear and circular polarizers, focusing lens and additional lenses coupled to or disposed within the illumination system or detection system (figs. 3 and 4: 38) (figs. 3 and 4) (col. 38, lines 28-col. 40, line 33) and thus meet the limitations [of claims 1, 11, and 21]." (Emphasis added).

Further, at pages 4-5 Examiner argues, "Fielden is silent regarding the optics specifically having a half-wave plate that receives the light beam. However, the use of (i.e. λ/2 wave plate) to receive light beam from a linearly polarized light source is known in the art. Further, Toida from the same field of endeavor teaches the use of half-wave plate (fig. 6: 128) that receives light beam (figs. 5-7) (col. 26, line 36-col. 29, line 5-10). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to provide optics that includes a half-wave plate that receives the light beam because it is easier to adjust/rotates the direction of the polarization of the beam than adjusting the source." (Emphasis added).

Appellant respectfully disagrees with Examiner. All words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 (a) is not whether the differences themselves would have been

obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983).

The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 82 USPQ2d 1385, 1395-97 (2007) identified a number of rationales to support a conclusion of obviousness which are consistent with the proper "functional approach" to the determination of obviousness as laid down in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966). The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. The Supreme Court in *KSR* noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Court emphasized that rejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

Continuing, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). If

the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

According to "SUMMARY OF THE INVENTION" at col. 3, lines 5-12, of Fielden, "An embodiment relates to a system that may be configured to determine at least two properties of a specimen. The system may include a stage configured to support the specimen. The system may also include a measurement device coupled to the stage. The measurement device may include an illumination system configured to direct energy toward a surface of the specimen. The measurement device may also include a detection system coupled to the illumination system." (Emphasis added). Further, col. 3, lines 20-28, of Fielden provide, "the first property may include a critical dimension of the specimen. The second property may include overlay misregistration of the specimen…a third property of the specimen may include a presence of defects on the specimen, and the fourth property of the specimen may include a flatness measurement of the specimen." (Emphasis added).

Continuing, col. 3, lines 28-44, of Fielden provide, "In an embodiment, the measurement device may include a non-imaging scatterometer, a scatterometer, a spectroscopic scatterometer, a reflectometer, a spectroscopic reflectometer, an ellipsometer, a spectroscopic ellipsometer, a bright field imaging device, a dark field imaging device, a bright field and dark field imaging device, a bright field

non-imaging device, a dark field non-imaging device, a bright field and dark field non-imaging device, a coherence probe microscope, an interference microscope, an optical profilometer, or any combination thereof. In this manner, the measurement device may be configured to function as a single measurement device or as multiple measurement devices. Because multiple measurement devices may be integrated into a single measurement device of the system, optical elements of a first measurement device, for example, may also be optical elements of a second measurement device." (Emphasis added).

Instead of, as contended by Examiner, teaching optical components that are capable of being arranged in the same manner as recited in Independent Claim 1, Fielden is directed to determining at least two properties of a specimen by utilizing a measuring device that may include a non-imaging scatterometer, a scatterometer, a spectroscopic scatterometer, a reflectometer, a spectroscopic reflectometer, an ellipsometer, a spectroscopic ellipsometer, a bright field imaging device, a dark field imaging device, a bright field and dark field imaging device, a bright field non-imaging device, a dark field non-imaging device, a bright field and dark field non-imaging device, a coherence probe microscope, an interference microscope, an optical profilometer, or any combination thereof. Moreover, since the measuring device may function as multiple measurement devices, optical elements of a first measurement device, for example, may also be optical elements of a second measurement device.

Further, element 48 of Fielden's Figures 3 and 4 <u>is a component of the measurement device 34 described by Fielden</u>, according to col. 37, lines 57-60 and col. 38, lines 62-66. As discussed above, Examiner contends element 48 of Fielden's Figures 3 and 4 corresponds to features of Independent Claim 1.

According to Fielden, the configuration of the measurement device 34 (which includes element 48) depends on the two properties (e.g., critical dimension, overlay misregistration, presence of defects, flatness measurement, etc.) being determined. Further, the measurement device 34 (which includes element 48) may be configured as a non-imaging scatterometer, a scatterometer, a spectroscopic scatterometer, a reflectometer, a spectroscopic reflectometer, an ellipsometer, a spectroscopic ellipsometer, a bright field imaging device, a dark field imaging device, a bright field and dark field imaging device, a bright field non-imaging device, a dark field non-imaging device, a bright field and dark field non-imaging device, a coherence probe microscope, an interference microscope, an optical profilometer, or any combination thereof. Furthermore, the configuration of the measurement device 34 (which includes element 48) depends on whether the measurement device 34 is configured as a single measurement device or as multiple measurement devices. Examiner does not argue that a specific configuration of the numerous configuration possibilities for measurement device in Fielden would make obvious the recitations of Independent Claim 1. Appellant submits the multiplicity of configuration possibilities for measurement device 34 would make non-obvious the recitations of Independent Claim 1.

More particularly, Fielden describes actual configurations for the measurement device in Figures 10, 11A, 11B, 23, 24, and 25. Examiner does not contend the configurations in Figures 10, 11A, 11B, 23, 24, and 25 teach the recitations of Independent Claim 1. Moreover, Fielden includes a significant number of passages directed to specific configurations for the measurement device (e.g., col. 43, lines 9-45; col. 44, lines 7-62; col. 46,lines 39-67; col. 47, lines 9-67; col. 48, lines 1-34; col. 49, lines 17-67; col. 50, lines 1-67, etc.). Examiner does not contend the specific configurations for the measurement device in the cited and other passages of Fielden teach the recitations of Independent Claim 1.

Additionally, Examiner admits Fielden is silent with respect to a half-wave plate. Appellant submits that Fielden is also silent with respect to “a long working distance microscope objective” of Independent Claim 1. Since Fielden is silent with respect to recitations of Independent Claim 1, Examiner’s allegation that optical components of Fielden are capable of being arranged in the same manner as recited in Independent Claim 1 cannot be sustained. Moreover, Toida fails to cure the deficiencies of Fielden.

Continuing, while the Examiner argues the reason for modifying Fielden is that optical components of Fielden are capable of being arranged in the same manner as recited in Independent Claim 1, this reasoning fails under the decision of the Supreme Court in *KSR*.

According to the Supreme Court in *KSR*, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. The reasoning provided is founded on merely conclusory statements instead of an articulated reasoning with some rational underpinning. The Supreme Court in *KSR* emphasized that rejections on obviousness cannot be sustained by mere conclusory statements.

As presented above, a prima facie case of obviousness has not been established because a) the combination of Fielden and Toida fails to disclose all the features of Independent Claim 1 and because b) the reasoning provided for modifying Fielden is legally insufficient. Thus, Independent Claim 1 is patentable over the combination of Fielden and Toida and is in condition for allowance.

Dependent Claims 5-10 are dependent on allowable Independent Claim 1, which is patentable over the combination of Fielden and Toida. Hence, it is respectfully submitted that Dependent Claims 5-10 are patentable over the combination of Fielden and Toida for the reasons discussed above.

With respect to Independent Claims 11 and 21, at pages 2-5 of the Final Office Action mailed 03/24/2009 Independent Claims 11 and 21 are rejected for similar reasons as those discussed with respect to Independent Claim 1. Therefore, it is respectfully submitted that Independent Claims 11 and 21 are

patentable over the combination of Fielden and Toida and are in condition for allowance for reasons similar to those discussed above.

Dependent Claims 15-18 and 22 are dependent on one of allowable Independent Claims 11 and 21, which are patentable over the combination of Fielden and Toida. Hence, it is respectfully submitted that Dependent Claims 15-18 and 22 are patentable over the combination of Fielden and Toida for the reasons discussed above.

CONCLUSION

For the extensive reasons advanced above, Appellant respectfully but forcefully contends that each claim (Claims 1, 5-11, 15-18, 21, and 22) is patentable. Therefore, reversal of all rejections is courteously solicited.

Respectfully submitted,

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CLAIMS APPENDIX

1. An apparatus for measuring surface topography of a surface comprising:

a linearly polarized light source that generates a light beam;

optics that focus the light beam on a surface to be measured such that a normally incident beam deflection is provided, the optics including polarization optics such that the incident beam has a first polarization and a reflected beam from the surface has a second polarization different from the first polarization, the optics including: a half-wave plate that receives the light beam from the linearly polarized light source; a long working distance microscope objective positioned to receive the light beam as an input from the half-wave plate and output a converging light beam; and a polarizing beam splitter positioned to receive as an input the output of the long working distance microscope objective and produce as an output a light beam with the first polarization; and

a position sensitive detector positioned to detect the reflected beam.

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. The apparatus of claim 1, wherein the optics further include a quarter-wave

plate positioned to receive as an input the light beam with the first polarization and output a beam in a direction normally incident to the surface, the reflected beam from the surface being reflected by the quarter-wave plate towards the position sensitive detector with the second polarization.

6. The apparatus of claim 5, wherein the first polarization is p-polarization and the second polarization is s-polarization.

7. The apparatus of claim 6, wherein the polarizing beam splitter includes a 45° reflective surface positioned to reflect the beam reflected from the surface in a direction perpendicular to the direction normally incident to the surface.

8. The apparatus of claim 1, wherein the long working microscope objective outputs the converging light beam in a direction perpendicular to a normally incident direction to the surface.

9. The apparatus of claim 8, wherein the optics further include a polarizing beam splitter having a 45° reflective surface positioned to reflect the converging light beam from the long working microscope objective towards the surface in a normally incident direction to the surface.

10. The apparatus of claim 9, wherein the optics further include a quarter-wave plate positioned to receive as an input the light beam with the first polarization from the polarizing beam splitter and output a beam that is normally incident of

the surface, with a reflected beam from the surface having the second polarization and directed by the quarter-wave plate through the polarizing beam splitter in a direction normal to the surface towards the position sensitive detector.

11. A method of measuring the topography of a surface, comprising the steps of:

directing a beam of light of a first polarization towards a surface to be measured, the beam of light being directed at the surface in a direction normally incident to the surface, with a reflected beam from the surface also being normally incident to the surface, the directing including generating a collimated beam of linearly polarized light and passing the collimated beam through a half-wave plate; converging the collimated beam with a long working distance microscope objective to output a converging beam; and transmitting the converging beam through a polarizing beam splitter in a direction normally incident to the surface;

changing the polarization of the reflected beam to a second polarization different from the first polarization;

directing the reflected beam with the second polarization to a position sensitive detector; and

determining the topography from measurements taken at the position sensitive detector.

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. The method of claim 11, wherein the step of changing the polarization includes passing the reflected beam through a quarter-wave plate that changes the polarization of the reflected beam to the second polarization from the first polarization.

16. The method of claim 15, wherein the step of directing the reflected beam includes reflecting the reflected beam perpendicularly at the polarizing beam splitter towards the position sensitive detector.

17. The method of claim 11, wherein the step of directing a beam of light includes directing the converging beam in a direction perpendicular to a normally incident direction to the surface towards a reflective surface of a polarizing beam splitter that reflects the converging beam towards the surface in a direction normally incident to the surface.

18. The method of claim 17, wherein the step of directing the reflected beam includes transmitting the reflected beam through the polarizing beam splitter in a normal direction to the surface towards the position sensitive detector.

19. (Canceled)

20. (Canceled)

21. An apparatus for measuring surface topography of a surface comprising:

a linearly polarized light source that generates a light beam;

optics that focus the light beam on a surface to be measured such that a normally incident beam deflection is provided, the optics including polarization optics such that the incident beam has a first polarization and a reflected beam from the surface has a second polarization different from the first polarization, the optics including: a half-wave plate that receives the light beam from the linearly polarized light source; a long working distance microscope objective positioned to receive the light beam as an input from the half-wave plate and output a converging light beam; and a polarizing beam splitter positioned to receive as an input the output of the long working distance microscope objective and produce as an output a light beam with the first polarization; and

a position sensitive detector positioned to detect the reflected beam;

wherein the optics further include the polarizing beam splitter having a 45^{o} reflective surface positioned to reflect the converging light beam from the long working microscope objective towards the surface in a normally incident direction to the surface.

22. The apparatus of claim 21, wherein the optics further include a quarter-wave plate positioned to receive as an input the light beam with the first polarization from the polarizing beam splitter and output a beam that is normally incident of

the surface, with a reflected beam from the surface having the second polarization and directed by the quarter-wave plate through the polarizing beam splitter in a direction normal to the surface towards the position sensitive detector.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None. Appellant is unaware of any related proceedings.